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A  
COMPENDIOUS METHOD,  
BY ONE SIMPLE  
PRINCIPLE of ASTRONOMY,  
OF  
ESTIMATING and CORRECTING  
THE  
DEFECTS and REDUNDANCIES  
IN THE  
Several SYSTEMS of CHRONOLOGY extant.

ADDRESSED TO THE ASTRONOMERS.

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# A COMPENDIOUS METHOD, by one simple Principle of Astronomy, of estimating and correcting the Defects and Redundancies in the several Systems of Chronology extant.

IT is generally agreed, that equinoxes, solstices, mean full moons, and mean new moons, with their corresponding days of the week, justly claim a place amongst the characters of chronology; but I shall attempt to prove, in the following sheet, that the mean astronomical epacts are as infallible criteria, or distinctions of the intervals of times, as any of the aforementioned characters, or all of them taken together.

In order to evince the truth of this proposition, I shall subjoin,

A TABLE of mean full moon epacts, or distances of the mean full moon before the autumnal equinox, for a series of thirty years.

	D.	H.	I	II	III		D.	H.	I	II	III
1	10	21	00	39	00	16	26	8	30	15	15
2	21	18	1	18	00	17	7	16	46	52	30
3	3	2	17	55	15	18	18	13	47	31	30
4	13	23	18	34	15	19	29	10	48	10	30
5	24	20	19	13	15	20	10	19	4	47	45
6	6	4	35	50	30	21	21	16	5	26	45
7	17	1	36	29	30	22	3	00	22	4	00
8	27	22	37	8	30	23	13	21	22	43	00
9	9	6	53	45	45	24	24	18	23	22	00
10	20	3	54	24	45	25	6	2	39	59	15
11	1	12	11	2	00	26	16	23	40	38	15
12	12	9	11	41	00	27	27	20	41	17	15
13	23	6	12	20	00	28	9	4	57	54	30
14	4	14	28	57	15	29	20	1	58	33	30
15	15	11	29	36	15	30	1	10	15	10	45



This table, by its construction, postulates,

- 1<sup>st</sup>, 365 d. 5 h. 49' 00", for the quantity of the solar tropical year.  
 2<sup>dly</sup>, 29 d. 12 h. 44' 1" 45", for the quantity of a mean lunation.  
 3<sup>dly</sup>, 354 d. 8 h. 48' 21", for the quantity of a mean lunar year, which being subtracted from the postulated quantity of the solar year, leaves in remainder,  
 4<sup>thly</sup>, 10 d. 21 h. 00' 39" 00", for the quantity of the mean astronomical epact, or distance of the mean full moon before the autumnal equinox, in the end of the first year of the world.  
 5<sup>thly</sup>, These 10 d. 21 h. 00' 39" 00" are set at the head of the table, and they are, properly speaking, the radical numbers, from which all the rest, by one uniform law of calculation, are derived.

As the law of the epacts seems not hitherto to have been sufficiently explained, I shall point out one remarkable particular, which might, perhaps, escape the reader's observation.

If we take any two numbers out of the table, which are at the distance of nineteen years from each other, the latter will be less than the former, in the unchangeable proportion of 1 h. 55' 51" 15".

	D.	H.	Min.	Sec.	Th.
EXAMPLE I. The epact N <sup>o</sup> 1. is	10	21	00	39	00
To 1 add 19, and the epact N <sup>o</sup> 20. is	10	19	4	47	45
The difference		1	55	51	15

EXAMPLE II. The epact N <sup>o</sup> 2. is	21	16	1	18	00
To 2 add 19, and the epact N <sup>o</sup> 21. is	21	16	5	26	45

The difference or decrease 1 55 51 15, &c.

As it is very necessary, rightly to understand the grounds of this difference, I shall here give a short explanation of it.

In 19 luni-solar years there are 235 lunations.

	D.	H.	Min.	Sec.	Th.
These 235 lunations produce	6939	16	26	51	15
19 solar tropical years give	6939	14	31	00	00

Moon departs from the sun eastward in every 19 years 1 55 51 15

Here it must be observed, that the distance of the mean full moon before the autumnal equinox (or any other cardinal point) constantly decreases, in the same proportion, as the distance after the cardinal point encreases.

This regular and uniform decrease being known, the *appropriated quantity* of the mean full moon epact, at the autumnal equinox, in any given year of our Lord,

Lord, and its corresponding solar tropical year of the world, may be readily ascertained to the precision of a moment; unless some person should be found able to correct the postulated quantities of a solar tropical year, and of a mean lunation.

I have said, the *appropriated quantity* of the epact in a given year; for so indefinitely various are the quantities of the mean astronomical epacts, and likewise so unerringly certain the calculation, by means of a regular and uniform law, that chronology will derive from hence an irrefragable argument in its support. It being evident, if calculation may be admitted for a proof, that every solar tropical year of the world is as distinguished by the calculated quantity of its mean astronomical epact, as every year of the Julian period is by the calculated combination of the three cycles of which it is compounded.

In order to prove what is above asserted, that the *appropriated quantity* of the mean astronomical epact may be calculated to the precision of a moment, in any given year of our Lord, and its corresponding year of the world,

*Let it be required to find, from the table of epacts, the distance of the mean full moon before the autumnal equinox, in this current year of our Lord 1763.*

To A. D. 1763 add 4007, the sum will shew, that at the autumnal equinox next ensuing, the sun will compleat its 5770th annual revolution.

If we divide 5770 years by 19, the quotient will give 303 compleat cycles, and leave in the remainder 13 years.

By the table (p. 215 of my System of Chronology) the moon's progression eastwards in 303 cycles, amounts to 24 d. 9 h. 3 min. 48 seconds, 45 thirds.

From 24 days subtract 1, for 49680 lunations, (see p. 208) and from the remainder subtract 1, to carry it back from the last to the first point of the mean full moon day, (see p. 216) and there will remain, for the corrected numbers, 22 d. 9 h. 3 min. 48 seconds, 45 thirds.

As there are 13 years over and above 303 compleat cycles, look for this number 13 in the foregoing table, and set down its epact.

	D.	H.	Min.	Sec.	Th.
N <sup>o</sup> 13. gives for the epact	23	6	12	20	00
Subtract for the moon's progressions in 303 cycles	22	9	3	48	45
Remains the mean F. M. epact at the aut. equinox	0	21	8	31	15

A. D. 1763

This calculated quantity of the epact will hold true in all places of the globe, provided the calculator be able to adjust the moment of the equinox, and the moment of the mean full moon to the same meridian precisely, for the least mistake in this nice adjustment, will occasion a proportionable error in the quantity of the epact.

The



The two following schemes represent to view the astronomical intersection of the true and mean full moon day, by the moment of the sun's entry into libra, the former at the creation, and the latter A. D. 1763.

Full moon day begins		H. O 24 O		Full moon day ends A. M. o.	
Mean full moon day begins A. D. 1763.	O	D. H. Min. Sec. Th.	O	Th. Sec. Min. H.	O Mean full moon day ends.
	O	o 21 8 31 15	O	45 28 51 2	O

*The quantity of the mean full moon epact, at the autumnal equinox A. D. 1763, proved by calculation from the original radix.*

		D.	H.	Min.	Sec.	Th.
5770 solar tropical years produce	-	2107448	10	10		
The included lunations amount to 71365,						
These produce	-	2107447	13	1	28	45
The difference is the full moon epact as above			O	21	8	31 15

If the table of epacts had been brought down by the same law of calculation, to the current year inclusive, the last in the order of succession would have been. o d. 21 h. 8 min. 31 sec. 15 thirds; and by this *appropriated quantity*, the year of the world 5770 is distinguished from all others which have passed before it.

Should any one be curious enough to enquire, in what space of time the same identical quantity of the epact will return again, at the same cardinal point, I would not limit such an enquirer to so narrow a stint as 600,000 years; and yet not one of the four chronologies compute quite 7200 years since the creation.

We say then, that A. D. 1763 is in a true connection with A. M. 5770, nor can it be astronomically connected with any other.

What is here offered are not theories to be disputed, but matters of fact to be tried.

Should it be objected, that neither Moses, nor any of the sacred writers, have recorded either a solar or a lunar eclipse, which would, without cavil or dispute, have authenticated their chronology; the answer is, that the regular and uniform decrease of the mean astronomical epacts, entirely supersedes the necessity of such an auxiliary; for by the sole assistance of this one simple principle, we are enabled to estimate and correct the defects and redundancies in the several systems of chronology to a single year, which is more than can be yet effected by the whole aggregate of solar and lunar eclipses which have happened since the creation. For how does an eclipse, under any consideration whatever, indicate to us the year of the world in which it was observed?

To evince that we are able to estimate and correct the defects and redundancies in the several chronological computations extant, we will take for an example that system which has been offered by archbishop Usher, who supposes time to have commenced at the autumnal equinox in the year of the Julian period 710.

A. D. 1763 falls in with the year of the Julian period 6476, from which subtract the year of the Julian period 710, and it will leave in remainder 5766 years for the past age of the world; the last year of which terminates, by the learned prelate's hypothesis, at the autumnal equinox in this current year of our Lord 1763.

But it is easy to prove, that the sun compleated its 5766th annual revolution at the autumnal equinox A. D. 1759, which falls four years short of A. D. 1763; and I shall prove it from the table of epacts.

If we divide 5766 solar years by 19, the quotient will give 303 compleat cycles, and there will remain 9 years of the 304th.

	D.	H.	Min.	Sec.	Th.
N <sup>o</sup> 9. in the foregoing table, gives for the epact	9	6	53	45	45
Add, to make the subtraction, one lunation	29	12	44	1	45
From the sum -	38	19	37	47	30
Subtract for the progression in 303 cycles	22	9	3	48	45
Remains the full moon epact A. M. 5766	16	10	33	58	45 00
Subtract for half a lunation - -	14	18	22	0	52 30
Remains the new moon epact A. M. 5766, ☉ in ♈, ferè	1	16	11	57	52 30

*Proved by calculation from the original radix.*

303 cycles produce 71205 lunations; add for 9 remaining years 108, and for intercalary months 2, then the sum of the lunations will be 71315.

71315 lunations produce 2105971 d. 00 h. 20 min. 1 sec. 15 thirds.  
5766 solar tropical years give by reduction 2105987 d. 10 h. 54 min.

	D.	H.	Min.	Sec.	Th.
From the solar tropical reduction	2105987	10	54	00	00
Subtract the lunar - -	2105971	00	20	1	15
Remains the full moon epact as above	16	10	33	58	45
Subtract for half a lunation -	14	18	22	00	52 30
Remains the new moon epact as above -	1	16	11	57	52 30



*To find the year of our Lord corresponding with the solar tropical year of the world*  
5766.

From 5766 subtract 4007, and the remainder 1759 will be the year of our Lord fought.

We will now examine and compare the results of these calculations, and then consider the chronological argument arising from them.

By the former calculation, the year of our Lord 1763 is found in astronomical connection with the solar tropical year of the world 5770, by means of the autumnal equinoctial full moon epact, whose *appropriated quantity* is 0 d. 21 h. 8 min. 31 seconds, 15 thirds.

By the latter calculation, the year of our Lord 1759 is found in astronomical connection with the solar tropical year of the world 5766, by means of the autumnal equinoctial new moon epact, whose *appropriated quantity* is 1 d. 16 h. 11 min. 57 seconds, 52 thirds, 30 fourths.

The chronological argument may be stated thus: These two years of our Lord, and their corresponding solar tropical years of the world, are as much discriminated by the different quality and quantity of their respective epacts, as they would have been, if a total and central eclipse had happened on the day of the new or full moon in the one year, and there had been no eclipse in the other.

Indeed when eclipses come to be calculated from the original radix downwards to the present times, and it is more than possible, that sooner or later they will be, then, like the *appropriated quantities* of the mean astronomical epacts, they will *characterize the years of the world*, and most signally establish the system of chronology.

It is evident, from the preceding calculations, that the *root of time* lies four years higher up than the learned Prelate conjectured; I say, the *root of time*, whose power, influence, and direction, is irresistible, nor can it be controuled by any erroneous hypothesis.

In this easy and convincing manner may every system of chronology be examined and brought to the test.

From A. D. 1763 subtract A. D. 1759, and the remainder 4 will express the sum of the deficiency in Archbishop Usher's computations.

I have addressed this to the Astronomers, as being the properest judges of the nature of these calculations, and of the argument deduced from them.

F I N I S.